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ABSTRACT

This report of a United Nations Educational, Scientific, and Cultural Organization (UNESCO) pilot project, which was carried out during 1982-84 in Khartoum (Sudan) to develop a vehicle for providing access to information on research in progress, describes: (1) the study that led to the conclusion that a national register of research projects was required in Sudan; (2) the collection of information for this register; (3) the procedures set out for its processing, production, and dissemination; and (4) the results of the study and suggestions for its future development. The register produced by this project is a single 552-page volume in English which lists 1,269 projects reported by some 300 sources both in the Sudan and outside. It is designed for use by researchers, research managers, and policymakers who require information on what, where, and how research is being organized and who is implementing it. The information in the register is intended to constitute a database for user referral to sources of scientific expertise; provide news of publications about to appear; and indicate potential users for scientific and technological information services. Fourteen annexes include questionnaires and other materials relevant to the study. A list of abbreviations, a 14-item bibliography, and a subject index are also provided. (CGD)

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Unesco Pilot Project on Information Research in Progress in Khartoum, Sudan

Final Report

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THE UNESCO PILOT PROJECT ON INFORMATION ON RESEARCH IN PROGRESS IN KHARTOUM, SUDAN

Final Report

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I - Co-authors

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PREFACE

This document is the report of a Unesco pilot project on information services on research in progress carried out during 1982-1984 in the Democratic Republic of the Sudan. Information on research in progress answers basic questions of interest to researchers as well as to research managers and policy-makers on what research is being done, where the work is being carried out, who is performing it and how it is organized and financed. For documentation centres and libraries, such information not only constitutes a data-base for referral of users to sources of scientific expertise but also provides indications of publications about to appear and of potential users for scientific and technological information services. Although information on research in progress has been a concern of Unesco for many years, both within its UNISIST Programme, now integrated within the General Information Programme, and its programme in Science and Technology Policy, it is clear that many Member States particularly the developing countries, have experienced difficulties in establishing viable national information services in this area which respond to the needs of all potential users. In this context it is hoped that the pilot project in Sudan, through the present report, will prove useful as a model to other Member States. Within Unesco, the project was supported through the Division of the General Information Programme and the Division of Science and Technology Policies, and the results are being used by both programmes in updating and harmonizing Unesco guidelines dealing with the handling of information on research in progress.

The report describes : the study which led to the conclusion that a national register of research projects was required in Sudan; the collection of information for this register; the procedures set out for its processing, production and dissemination; and the results of the project and suggestions for its future development. Mr. John C. Creasey (of the Headquarters Library of the Department of the Environment (UK)) who was the Unesco consultant to the project based the document on the reports of his two missions to Khartoum and that of Ms. Cecile Wesley (Director of the National Documentation Centre of Sudan and team leader of the project).

Comments and suggestions on the present document, as well as requests for additional copies, are invited from the readership and should be addressed to Division of the General Information Programme, Unesco, 7 place de Fontenoy, 75700 Paris, France.

The National Council for Research has agreed to make a limited number of copies of the National Register of Current Research - 1982/1983 and the supplement 1983-85 available to interested institutions, researchers and information specialists. Requests should be directed to the National Documentation Centre, P.O. Box 2404, Khartoum, Democratic Republic of the Sudan.

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Abbreviations Used

ADB	African Development Bank
AGRIS	International Information System for Agricultural Sciences and Technology
ARC	Agricultural Research Corporation
CARIS	Current Agricultural Research Information System
CEC	Commission of the European Communities
EDP	Electronic data processing
FAO	Food and Agriculture Organization of the United Nations
IDRC	International Development Research Centre, Ottawa, Canada
NCC	National Computing Centre
NCR	National Council for Research, Sudan
NDC	National Documentation Centre, NCR Sudan
PADIS	Pan African Documentation and Information System
R & D	Research and Development (projects)
SSU	Science Statistics Unit, NCR, Sudan
STP	Scientific and technological potential (survey information about scientific organizations, finance, personnel and equipment)
UNECA	United Nations Economic Commission for Africa
UNICEF	United Nations Children's Fund
UNDP	United Nations Development Programme

1. Introduction and background

During 1981 the Director of the Division of the General Information Programme, Unesco, communicated with the national information focal points of a number of Member States, particularly in developing countries, to invite their participation in a Unesco-supported pilot project concerned with the establishment of a national information system and service on research in progress. The aim of the project was to establish an operational model for a viable information system on research in progress at the national level in a developing country to serve the needs of decision makers and managers in research and development, working scientists and other potential users.

This proposal, responding to international concern about improvement of information on national science and technology capacity, programmes and users, expressed at the 1979 United Nations Conference on Science and Technology for Development, had been made at the Unesco General Conference at its 21st session in 1980. Consequently Unesco included a provision in the 1981-83 work plans for its General Information Programme and its programme in Science and Technology Policy that one or more "pilot projects relating to the establishment of information systems and services on research in progress will be undertaken, especially in the developing countries".

In December 1981 a favourable reply was received from the government of the Democratic Republic of the Sudan. Unesco replied in January 1982 to the Secretary General of the Sudanese National Commission for Education, Science and Culture suggesting a Unesco consultant mission to develop plans for the pilot project.

The consultant mission took place on 10-24 February 1982 "to advise on the development of information services on research in progress and on the work plan for implementing a possible pilot project in this field". In carrying out the mission, the consultant was to collaborate closely with the national authorities responsible for planning and use of information services on research in progress, and take full account of the existing Unesco guidelines and documents on the subject.

During the briefing of the consultant at Unesco it was agreed that research project descriptions, in addition to providing valuable information services to the research and development communities, were likely to be linked to the area of national budgeting and planning in two respects :

- the possibility of collecting some research project information more effectively from the records arising from accountability for expenditure;
- the potential value of aggregated research project records in decision-making for budgeting and national planning purposes.

It was agreed that the study should include these aspects as far as possible.

1.1 Geographical and economic aspects

The Democratic Republic of the Sudan is the largest country in Africa and the eighth largest in land area in the world with around 2 1/2 million square kilometres; the population of about 17 1/2 million is relatively small. It is bounded by eight countries and stretches from latitude 4 to 22 N. The towns are few and widely scattered, and the high temperatures are rarely mitigated by altitude. The rainfall ranges from almost nothing in the north to 57 inches in the south, and from desert to high rainfall savanna and inland flood plains. Only about 15% of the population are truly urban. Northern Sudan is predominately Muslim with acceptance of the Arabic cultural heritage while the South presents a mix of negroid tribes and languages, with its own special traditions.

Sudan has great agricultural ability and potential and is not strained by a population explosion as are many other developing countries. The agricultural sector provides the basis of the economy and contributes about 40% to the gross domestic product, employing 80% of the economically active population and accounting for 95% of export revenue. Over the years there has been great reliance upon the export of cotton which has been at the mercy of fluctuating markets. Some priority has been given to development of the irrigated sector as well as to areas of the economy like transport, as part of the six-year plan for economic and social development 1977/78 - 1982/83.

1.2 Regional government

As a result of the Addis Ababa agreement of March 1972 the southern region of Sudan (divided in 1983 into three provinces) became self governing and responsible for all matters except national defence and security. Under the Regional Government Act of 1980 Northern Sudan was divided into five regions : Darfur, Kordofan, Central, Eastern and Northern regions with special status for Khartoum Province, while the Southern region retained both its autonomy and boundary. The 1980 Act devolved authority to provincial councils so that regional government, as a basic part of government, was embodied in the constitution under section 8, of which one of the most important domains is finance : "The regional assembly is empowered to pass its own budget and the regional government can obtain revenue from direct and indirect regional government taxes, regional, industrial, agricultural and commercial activities as well as central government grants and loans."

At the time of the pilot project Khartoum had some 80% of the research organizations amidst about 20% of the population. Some difficulty has been experienced in collecting statistical data from the provinces and this might apply increasingly to information about research projects until the new decentralised systems are established.

2. Survey of needs

The basic objective of the preliminary consultant mission was to learn about the position of research information in the country and seek responses to the idea of a national research project information register and service. The initial investigation took the form of a series of twenty interviews conducted with representatives of research councils, government ministries, the university as well as sections of the National Council for Research where the National Documentation Centre was the official counterpart for the mission. The interviews were structured in order to allow comparison of the responses to key issues and were supported by extensive reading of current and recent official documents.

2.1 Overall findings

The findings were quite clear in two main respects :

a) general agreement that there was little formal organization of research project information and little communication among many of the administrative and subject sector groups concerned;
b) general agreement on the need for readily available summaries of research projects on Sudan in the form of a national register of research, in order to assist research workers, research managers and policy makers.

There was varying emphasis on a number of supporting points including the following :

a) the value of knowing of project duplication;
b) the need to include surveys and studies in any national research project scheme;
c) the need for a unified budget for research and the strengthening of the National Council for Research legislation for this purpose;
d) the value of better housekeeping records by organizations which fund and perform research;
e) the need for better project control through the use of contracts.

The institutional structure for science and technology in Sudan and the position of the National Council for Research (NCR) had been clearly established at this stage (see annex 1).

The endeavours of the National Council for Research had been well presented by Dr. Sammani Abdalla Yacoub in his paper at the UNISIST Symposium in Paris in 1975 (1). He said that "with the limited material resources available, efforts are normally made at all functional levels of NCR to rationalize the expenses required for projects. Possible duplication and repetition of research, both on a national and international level, is the main concern of committees and councils. Hence the main constraint, and sometimes a real handicap, is the lack of availabililty of information for those concerned with making the decision". The former Secretary General of NCR went on to say that "the determination of priorities in the research plan is generally governed by a number of factors, some of which are :

a) whether the research project is relevant to the objectives and the targets of the national socio-economic development plan;
b) whether the research project can be carried out by a national team ...;
c) whether the requirement of the project in terms of equipment is minimal, or use can be made of equipment already available ...;
d) whether such a project ... is currently being tackled in any other national research body;
e) whether a similar project has already been undertaken nationally in the past;
f) whether the results of a similar project undertaken internationally have been produced and proven adaptable to the local environment;
g) whether the results of the research project can be immediately applied to development ...".

It can be seen that the meeting of information requirements (d), (e) and (f) is dependent upon the existence of a research register, a current register in the case of (d), a retrospective register for (e), an international register or system for (f), and an expertise directory (which can be considered as a research register by-product for (b). The Sudan national paper to the UN Conference on Science and Technology for Development, held in Vienna in 1979, admitted that the contact between indigenous results and users of findings was weak. This is a comment on (g) which could equally be assisted by a register.

The estimates provided in the interviews of the number of current research projects being conducted in Sudan varied enormously. Most people thought that anything around the figure of 1000 was far too high and the 1977/78 official survey of scientific and technological potential (2) seemed to confirm this view with a count of 400. However, the evidence from the Agricultural Research Corporation's research volume (3) as well as indications from CARIS (4) and several registers and databases from the United Kingdom and the United States strongly supported a higher figure of about 1000 projects and justified the already-expressed need for better coordination and better knowledge of national and international research project information on Sudan.

2.2 Scientific and technological potential (STP), research and development (R&D), budgets and planning

Research projects are set in the context of the infra-structure and working procedures of the national scientific community and therefore some consideration was given to the community's activities and influence. Sudan has a long tradition of scientific study and research since the first medical research laboratory was established in 1902 and the first agricultural research station in 1904.

STP is concerned with a regular survey of the finance, equipment, personnel and activities relating to research in national scientific institutions, for use primarily in the planning and budgeting of national R&D efforts. A methodology for STP inventories (17) has been developed within Unesco's programme in Science and

Technology Policy and applied in numerous Member States. Starting in 1974 three STP surveys were undertaken by the Science Statistics Unit of the NCR, and a fourth was in preparation at the time of the mission (see section 3.3).

Although research projects have an average life of about three years they are more inclined to change than the STP institutional elements of finance, personnel and equipment and therefore require more frequent monitoring to collect information on changes, completions and new projects.

Sudan was shown to have two types of research grants; the block grants of the research councils and universities, and the specific contract grants of the ministries. The system was in course of change to a unified research budget under the control of NCR. In future five subject sector groups, as follows, were to be required to prepare a budget claim to be put forward by their particular ministerial leader to the NCR budget committee :

a) Agricultural sector - served by the Agricultural Research Council and headed by the Minister of Agriculture.
b) Health sector - served by the Medical Research Council and headed by the Minister of Health.
c) Economic and social sector - served by the Economic and Social Research Council and headed by the Minister of Finance.
d) Scientific and Technology sector - served by the Scientific and Technological Research Council and headed by the Minister of Planning.
e) Energy sector - served by the Energy Research Council and headed by the Minister of Energy.

Each sector would ensure the representation of the appropriate research units in the ministries and departments, the universities and higher education, and the national research councils. The budget sources will consist of the Government, the revenues of the research institutes, the aid and grants from the public and private sector, foreign financing, and assistance from regional and international organizations.

A national research project database of ongoing research was seen to be of considerable potential value for such matters as :
a) an overview assessment of research activity;
b) planning research programmes;
c) administration of multidisciplinary projects;
d) identifying research results of potential value for development support;
e) general provision of research information, particularly for NCR and for subject-sector budget discussions.

3. Organizations concerned with implementation

3.1 The National Council for Research

NCR forms a natural focus for any development of a national register of research because of its history and responsibilities (see annex 1). The National Council for Research Act 1977 specifies the following objectives :

a) to encourage, organize and promote scientific research;
b) to formulate comprehensive policy for scientific research ...
c) to plan for the establishment of centres for scientific documentation, scientific statistics and information ...
d) to endeavour to publish the results of scientific research ...
e) to maintain complete and accurate records which shall indicate the dates of all accomplishments and results of researches ...

NCR has five subordinate specialized councils :

a) the Agricultural Research Council;
b) the Scientific and Technological Research Council;
c) the Medical Research Council;
d) the Economic and Social Research Council;
e) the Energy Research Council.

Work was already well advanced on the new headquarters and working structure for the NCR. The Board of Directors has a Chairman of cabinet minister rank who has direct access to the President of the Republic. The new accommodation, the consolidated budget and the revised working structure should enable NCR to considerably improve the part it plays in science policy and planning. It was noted that part of the consolidated budget is intended for reinforcing the National Documentation Centre and strengthening its relations with research institutions, libraries and local and international documentation centres.

3.2 The National Documentation Centre

NDC, which is involved in the NCR plans for administrative reorganization, was set up in 1974 and, after some years of operational support by Unesco and the United Nations Development Programme (UNDP), received its first full time director in 1978. The Centre seeks and maintains a wide ranging stock of documentation from which it provides valuable reader services. It also produces a current awareness bulletin, Sudan Science Abstracts. NDC had at the time of the mission six in-house staff consisting of two new graduates, three library assistants and a part-time cataloguer. Three additional staff were away training.

Two extra trained staff were seen to be required by NDC for any proposed national research project activity. They would need to collect research data by questionnaire and by directly approaching

key funding organizations and performing bodies where block transfer of records seemed likely. They would edit, classify and index the returns and maintain an in-house reference file while liaising with the Science Statistics Unit and preparing the information for a printed register to be widely distributed, notably to contributors. The regular collection of research project information would ensure that the results and publications of projects would be included, where appropriate, in Sudan Science Abstracts as well as alerting NDC to new publications, organizations and scientific activity.

3.3. The Science Statistics Unit

SSU is part of NCR and had 16 members of staff at the time of the mission. For the last (third) STP survey in 1977/78 it had collected data from 700 scientific units and 4000 personnel, and had used five questionnaires structured as far as possible in conformity with the Unesco guidelines (17). These questionnaires - for finance, organizations, scientific personnel, research projects and equipment - were the means of collecting information which was processed by computer. It was understood that SSU was working towards pre-coded questionnaires for improved computer processing of information to be collected in the fourth survey.

3.4 Proposal of an executing body

It was seen that information on ongoing R&D can be considered as falling into two categories with district demands upon the institutions responsible for information collection management and dissemination :

Research project information	Other STP information
a) Regular annual collection	Every few years
b) Collection by questionnaire and directly from records	Collection by questionnaire Personal interviews often necessary
c) Requires staff trained in classification & indexing	Requires trained statisticians for analysis
d) Project information is subject based	Non-project information is organization-based
e) Wide range of users	More limited distribution for specific users
f) Quick production essential	Slower production allowed
g) Cumulative reference facilities needed	Self sufficiency of each survey publication
h) Special location required for research reports	Special housing for reports not required

The above comparison showed that the collection, processing and dissemination of research project information were best dealt with by NDC and the other STP matters by SSU, but with close liaison on the survey schedule, the statistical elements on the questionnaire and their processing.

4. Related Plans and activities

At the time of these developments there were three major concerns, one international and two national, which needed to be considered because of their potential bearing on the research register proposal :

a) PADIS - Pan African Documentation and Information System
b) The Presidential Science-based State Proposals
c) National Computer Centre plans

4.1 Pan African Documentation and Information System (PADIS)

PADIS (5) is developing under the aegis of the United Nations Economic Commission for Africa (UNECA), and is supported by contributions from UNDP, UNECA, Unesco, IDRC, ADB and others. The objective of this system, which works in English, Arabic and French and has its headquarters and main database in Addis Ababa, is to provide ready access to information, both published and unpublished, that is required by policy makers, technicians, planners and others engaged in the economic and social development of African states. Although initial activities have stressed bibliographic information a stated main task of the system is the establishment of a register of socio-economic research and development projects. Also it aims to establish links (systems inter-connection) with international information networks, databases and documentation units outside Africa. This is only part of a wide ranging and ambitious programme. The system aims to use the most recent technology of data transmission, including telecommunications satellites, and provide the necessary training and support.

Equipment needs had already been discussed with the National Documentation Centre which had been nominated as the PADIS centre for Sudan. The proposed equipment consists of a Hewlett-Packard 3000, series 4 computer with six video terminals. The HP 3000 series 4 is a medium sized flexible mini-computer which can be used in a stand-alone capacity or as a node in a network of computers. The standard Multi-Programming Exectutive (MPE) operating system may be used on any model of the HP 3000 series and supports a wide range of application software. It was understood that the MINISIS software developed by IDRC would be used in the Sudan system. This may have very useful implications because the same software has been used by CARIS for which there is an Arab regional centre in Khartoum and a national centre in Wad Medani.

There was an ambitious programme set out for NDC in relation to PADIS in terms of equipment, accommodation and staffing. This could assist and certainly influence any longer term development and use of research project information.

4.2 Building the Modern Science-based State

In June 1981 the President of the Republic in his address to the National Council for Research stated some of his main aims as follows :

a) raising the proposed budget for the sciences from 28% to 5% of the GNP;

b) decentralisation of power to local government and more self reliance;

c) modern management and encouragement of research workers;

d) preparation of draft legislation to encourage scientific research;

e) studies to facilitate formation of science research units in all government departments;

f) establishment of scientific campuses in the regions;

g) drafting of a unified research budget by the National Council for Research which would provide checks before passing if for ratification, so that applications are in concert with strategies and national priorities.

h) support for the National Council for Research in preparing programme guidelines.

On 19 October 1981 the President of NCR presented the sub-programme reports of the 12 groups specially created to work on the science-based state theme, as requested by His Excellency the President. The introduction distinguishes the science research programmes for 1980/85 and 1985/90 and relates them to the national development plan.

4.3 The National Computing Centre (NCC) and informatics plans

In 1980 there was a Unesco-funded consultant report which surveyed the computing scene in Sudan. The report recommended improving support and coordination of national electronic data-processing activities through :

a) standardization of EDP equipment;

b) standardization of programming languages;

c) training EDP equipment operators in preventive maintenance techniques;

d) ensuring reliable contracts for periodic maintenance and repair;

e) installing electrical voltage stabiliser equipment as well as emergency electrical power supply for essential installations.

In this context the newly created National Computing Centre conducted a survey of some 64 private organizations, which expressed interest as potential users for the three main services proposed by NCC, namely :

a) training (National Computer Training Centre)

b) service bureau (National Service Bureau)

c) computer network facilities (National Computer Network).

Apart from the possibility of general support for development of a computerized research register, there was the more immediate prospect of the bureau service allowing the NCR Science Statistics Unit to process important national statistics within the country instead of in Cairo or elsewhere.

5. Proposed objectives of the pilot project

Taking into consideration the findings of the preliminary mission, the consultant set out proposed objectives for the national information system on research in progress, which were submitted in mid-1982 to the Sudanese Government in a Unesco report (13) covering the following headings :

a) guidelines for the preparation of a register of research consisting of short comments on the sequence of taks from preparing for collection of the information to production (All items of this initial outline were subsequently incorporated into the expanded guide for research register operations presented in section 8);

b) conclusion : a general description of a research register unit and some of the benefits that might arise from its operation;

c) recommendations

5.1 Conclusion of the first mission

The effectiveness of the Research Project Register in Sudan was seen to depend upon :

a) easy use
b) comprehensiveness
c) swift production
d) wide distribution and publicity
e) wide usage and feedback comment
f) action to meet users'needs

The Register Unit would therefore have to be constantly alert and responsive throughout the year. One may need to provide or arrange for a particular analysis which is not published in the Register, seek out related projects recorded earlier or currently being processed, note a new survey source, follow up research results, or obtain further information from the research worker and provide a host of varied support services.

The register volume should be structured and indexed as a self-help and referral tool for most users. The administrators and planners may well need a slim analytical commentary as an annual supplement produced jointly by NDC and SSU.

Accountability records arising from expenditure should become increasingly important with the new move towards a unified budget for research and towards greater awareness of expenditure; records and contracts might well gradually increase the ease and effectiveness of information collection in Sudan. Research organizations and funding bodies were expected to see the value of quickly accessible summary records for annual reports, budget claims and other purposes, and this would in turn encourage input to the research project database. There is great sense in using project summary records which have to be created anyway in accounting for agreements and money transfers between funding agencies and performing organizations, and between funding agencies and research workers, or performing organizations and research workers. The contract was seen as a means of tightening control on staff and on the results to be provided in a certain time scale. All large cooperative exercises of importance are helped by the rewards and incentives of self-help mechanisms. The record system which a given major organization creates in dealing with its research expenditure and personnel contracts may not at first be ideally formatted or even centralized, but can gradually be improved for the mutual benefit of the organization, the national scientific community and the country at large.

Finally, the outcome of all this effort to expend money wisely upon research is the result - in the form of interim and final reports, technical articles in journals, unpublished papers, pamphlets, booklets and books, or even no more than a short summary of findings. Whatever findings can be obtained and wherever they come from, if they are the result of research in Sudan, about Sudan or of value to Sudan, then potential value is in the hand for dissemination, use and development, and NDC should be playing a very active role as the central reference depository of this information.

5.2 Summary of the recommendations

a) A classified and indexed National Register of research project descriptions covering all subject fields and with a broad definition of research embracing surveys and studies of significance, should be compiled annually and widely distributed to meet the requirements of a range of potential users.

b) The National Documentation Centre should be responsible for the collection of project information, the compilation and production of the National Register, and for all related processing, distribution, liaison and services. Manual methods should be adequate to carry out this work, although the procedures should be designed with a view to facilitating future computerization. A stencil duplicator and heavy duty stapler, etc., should be provided.

c) The National Documentation Centre should also use the opportunities arising from the Research Register source contacts to : (i) observe and encourage systematic in-house record keeping among source organizations by use of an office information summary sheet (see annex 2) and (ii) trace and acquire published and unpublished documents for national use.

d) NDC requires two new librarian/information posts to be filled by full-time professionals, one of whom should have additional science qualifications.

e) The NCR Science Statistics Unit should continue to be responsible for the STP surveys except for research project information, on which it will liaise with NDC when statistical aspects are involved.

f) The National Council for Research Act of 1977 should be strengthened to explicitly mandate the activities suggested in points (a) & (e) above (an amendment proposed by the consultant for this purpose is given in Annex 3).

g) NDC should collect and record project information on Sudan appearing in national and international registers and information systems.

h) The general use of research contracts with appropriate incentives and penalties should be encouraged (in part to ensure the collection and availability of needed research information).

i) A second consultant mission should be arranged to assist with the first production cycle of the Register.

5.3 Initiation of the project

Later in 1982 the Government of Sudan responded to the report and recommendations by accepting to host the Unesco pilot project along the lines proposed and by requesting a further consultant mission. There was particular comment on the staffing recommendation to the effect that it was not feasible to appoint two graduates with

appropriate subjects who were also qualified in library or information science. This was because of the severe shortage of trained manpower due largely to the tendency of qualified staff to accept positions of employment abroad. Consequently, training would need to be carried out on the job.

The second mission from 12 to 31 March 1983 was funded by Unesco under its Regular Programme for 1981-1983. The terms of reference were : "To advise the National Documentation Centre of the National Council for Research, on the development of the Unesco pilot project on information services on research in progress, to train and assist the local staff in compiling the inventory of national research projects, notably by preparing a manual for this work, and actively participate in a national symposium intended to familiarize users with the research inventory and elicit their suggestions for future information services."

6. Methodology

6.1 Collection of information

The National Documentation Centre conducted the collection of the research project information before the arrival of the consultant and has reported that phase as follows :

Questionnaire forms, together with a covering letter were sent on 21 October 1982 to about three hundred organizations including ministries, universities, colleges, research organizations, embassies and regional and international organizations resident in the Sudan, as well as individual research workers.

The American Centre in Khartoum was contacted to provide information on relevant research projects from the Smithsonian Science Information Exchange database (6). Also the Unesco consultant brought with him relevant project descriptions from the British Library's Research in British Universities Polytechnics and Colleges (7) and from the Overseas Development Administration of the United Kingdom. Use was also made of the publication Sudan and Sudanese, a bibliography of North American dissertations and theses on the Sudan (compiled and edited by Osman Hassan Ahmed).

Organizations were contacted several times by telephone to remind them to send the completed forms. A final follow-up letter was sent on 29 December 1982, followed by many visits to research units in the three towns of the Khartoum area and Wad Medani. There was often a need to make a direct approach to individual research workers. Use was also made of two contacts in the Southern region, the UNICEF office in Juba and the Juba University librarian.

The criteria for research project relevance consisted of a broad research definition including surveys. It excluded masters theses.

The first week in March 1983 was chosen as the deadline for information collection. Nevertheless, no forms received later were rejected. Out of the total number of forms received, thirty five were outdated or irrelevant research projects and forty were masters theses. Eight institutions responded that they were not carrying out research at the time.

Although information collected for the Register was supposed to be for research projects currently being implemented, a few research projects which did not conform strictly to this criterion were ultimately included : one research project (No.620) had not yet been approved. Three research projects (No.351, 352, 995) had not yet started. Six research projects (NO. 308, 700, 846, 847, 848, 849) had been submitted for financing and for one research project (No.905) the financing agency was not yet determined. The total number of research projects described and analyzed in the published Register (11) is 1273.

Two questionnaire forms were used, one was designed by the Agricultural Research Corporation (see annex 4) and the other by the National Documentation Centre (see annex 5). The Agricultural Research Corporation had been considering a supplement to its register of research. ARC agreed to cooperate with NDC using its own questionnaire which is specially suited to agriculture with additional information on crops, research station section and the particular growing season involved. In addition the ARC questionnaire foresaw the breakdown of project summary information into objectives, methods, observations and results and of the financial information into chapter I, II or III of the budget.

6.2 Work accomplished during the second mission

It was noted that many of the ARC replies had been returned on questionnaires headed "Provisional Programme of Work", so that unless the corresponding projects had progressed beyond the first season or had some money attached, it was difficult to know if they were formally supported. Although checks were made this matter was never wholly resolved.

It was noted in the layout of the NDC questionnaire that not having the summary of the project adjacent to the title was a disadvantage when it came to the transfer of the information for preparing the printed format. It was also obvious that many people had been uncertain about how to select the appropriate questionnaire box for fundamental research, applied research and experimental development, and criteria for this choice were subsequently provided (see annex 6). A ten digit box had been provided on the questionnaire for a unique project number to be assigned by NDC, a device that may not be fully used in a manual system, but is nevertheless a wise measure.

For the classification and subject index it was decided to start using the Unesco international standard nomenclature (8) for fields of science and technology, as well as the Agricultural Research Corporation register classification. The first is discipline-based and the second is crop-based.

Slips of paper with classification headings and index terms were prepared for each entry and pinned to the appropriate questionnaire. This slip method assists the eventual sorting and typing of alphabetical sequences for indexes. Index slips of standardized entries for research worker and research organization can be processed while the classification and subject indexing is proceeding.

The names of the research organizations needed standardizations : basically to bring the university name to the front and to agree on a standard description and order for the agricultural research stations.

There are two name index possibilities when expressing Arabic names - the first or the last name as dominant. After much discussion it was decided to adopt the western practice of the last name. On the question of the inclusion of titles like Dr. and Prof., two main benefits were considered :

(i) As the Science Statistics Unit was found not to be carrying out the scientific and technological potential survey, maintaining the distinction could yield useful statistical information.

(ii) Such titles could be a useful comment upon the level of individual expertise.

However, it was decided in the end for reasons of simplicity and equality to adopt the customary title "Sayad" throughout.

It was decided that when all the returned questionnaires were in an assured classified order, the graduate statistician would attempt a range of analyses concerning projects, finance and administrative areas, etc.

In considering the final version of the text of the Register, NDC was to use an ordinary typewriter or an electric "golfball" typewriter provided by Unesco for which two further heads were on order. The acquisition of a duplicator for the project by Unesco was still in the process of being arranged, and it was thus proposed to send the first Register out to a printer who would use camera-ready copy and then duplicate and bind. A free copy of the Register was planned to be provided to every information source.

Varying numbers of staff had been employed in the early stages of the project making use of a temporary grant from Unesco and a full complement of five new graduates were in post when the consultant arrived. They consisted of three scientists, one agriculturalist and one statistician.

Most of the training involved working closely with the staff on all aspects of the classification and indexing activities. The main considerations are set out in the Guide for Research Register Operations section (see section 8.3).

6.3 Schedule for completion of the Register and follow-up

At the end of the mission the following schedule was established for the completion, dissemination and updating of the National Research Register :

(a) completion of the current register by the end of 1983;

(b) initiation of publicity and marketing just before the end of 1983 and distribution of the register early in 1984 to contributors and key contacts like libraries, committees, secretariats and selected decision makers, research managers and research workers (asking users for constructive comments for consideration in the next volume);

(c) gathering of comments at the end of the first quarter of 1984 and review content and methods;

(d) collection during 1984, spread between March and September, of information on new projects, and updates of those due to finish in 1984.

6.4 Recommendations of the second mission

A number of general recommendations were proposed following the mission (14) to facilitate the development of the national information system on research in progress in the Democratic Republic of the Sudan :

a) That the momentum of the work initiated by the National Documentation Centre should be maintained by ensuring adequate regular staff.

b) That in order to ensure the future conditions for the development and regular production of a national register of research projects, attention should be paid to general administrative support, and in particular the implementation, or effective working where arrangements already exist, of the following specific recommendations which the President of the National Council of Research suggested for incorporation as Bye-laws within the National Council of Research Act of 1977 :

(i) every new research project should be registered with the National Council for Research (the national research coordinating body) by all organizations responsible for conducting research. Stocks of forms to be held by the National Documentation Centre to whom all completed forms should be sent;

(ii) that research organizations and research funding bodies, when seeking acceptance for the start of a new research project, should provide a declaration of a satisfactory search of the latest national register of research, showing that there is not any similar work being conducted;
(iii) the National Documentation Centre of the National Council for Research should receive a copy of the documented results of each project, or if that is not possible, a full reference and a location address for access to the results.

7. Publicity and discussion

7.1 Announcement in the Press

Short accounts of the project appeared in two national newspapers, El Sahafa on 10 March 1983 and in El Ayam on the previous day. The benefits were described as :
(i) a presentation of active expertise;
(ii) a link with research workers both inside and outside the country;
(iii) an input to planning and development.

7.2 Lecture and symposium

Some three hundred potential users of the Register were invited to a symposium in order to :

a) acquaint them with the progress in preparing the Register;

b) demonstrate its usefulness in planning and decision-making;

c) get some feedback from those attending.

After the presentations and the consultant's lecture (given in annex 7) there were very useful discussions between the participants and the organizers of which a summary follows :

(i) Q. Are keywords for indexing provided by the sources only or are they supplemented ?
Q. What expertise exists for assigning keywords ?
A. Space is available on the questionnaires for suggestion of keywords, but these are examined in relation to the text and supplemented where necessary. The young graduate staff at NDC with specialisations in various branches of science, agriculture and statistics are coping admirably under the leadership of the Director.

(ii) Q. Will the research worker indexes use first or last names ?
Q. What transliteration standard is in use for translation from Arabic ?

A After much deliberation it has been decided to use last names in the research worker index. It has not been found necessary to decide on a transliteration standard. (The questionner was thanked for his suggestion of a standard from the Encyclopaedia of Islam).

(iii) Q The forms need redesigning with more space. So you agree ?
A A modified questionnaire form is under discussion but planned as one sheet to aid production and handling.

(iv) Q Why only current research in the Register ?
A It is the intention to include recently completed research and to continue this in subsequent volumes.

(v) Q How will completed research be handled ?
A Results and reports will be referenced insofar as possible within each research description, and linked with the NDC Sudan Science Abstracts which is responsible for carrying details of papers and publications arising from the research projects.

(vi) Q What percentage return was obtained ?
Q What proportion of relevant research was returned ?
A All organizations approached made some reply even if it was a nil return, but some needed a great deal of persuasion. Returns are obviously less than the complete return possible from all relevant organizations but the shortfall is not known.

(vii) Q Why don't you include expertise that would not be evident from the contents as planned at present ? Some known experts are not currently engaged in a research project or even living in the Sudan.
A This is a useful point and suggestion which will if possible be taken up within the Register, provided the additional information does not lead to the need for a second volume.

(viii) Q Many feasibility studies are technical and many have little to do with research. How important are these ?
A Studies and surveys supporting development projects should be considered as relevant insofar as they have any useful original contribution to make. Documents should be systematically recorded and housed for quick reliable access, even if they cannot all be made publicly available.

(ix) Q If the new Register leads to the discovery of duplicate research, will the National Council for Research have the power to stop the work ?
Q NCR will need teeth to carry out its functions. How will these be provided ?
Q What will be the exact coordination role of NCR ?

A. The President of NCR said that NCR did not require teeth; its function was like a crucible for the collection of information, combined with the appropriate arrangements for nurture where need arises.

(x) Q. Why isn't there a law for the registration of all research and research workers, and not just those from overseas ? This did not receive a specific answer, nor did the audience respond to the question on the use of the office summary sheet which had been handed to all those present (see annex 2).

(xi) There was agreement from at least one member of the audience that there are people in Sudan like those described in the story of the professor who proclaimed registers a waste of public money, although the staff for whom he was responsible were in need of such aids to avoid duplication and assist their own work.

(xii) There were also some encouraging expressions of support for the concept and activity of the National Register.

8. Guide for research register operations

Register compilation and production is unlikely to follow the same detailed procedure year after year. Inevitably changing demands and opportunities lead to gradual and even dramatic alterations in methods, and therefore a range of options must continually be under review. The present section is intended as a general guide in establishing a national Register of research projects, taking particular account of the experience in Sudan.

The information is set out under four main headings as follows :

(a) Research information
(b) Collection
(c) Editing, classification and indexing
(d) Production, publication and marketing

It is clear that computerized techniques can be very useful in the editing, processing, analysis, publication and retrieval of research project information, particularly when it is considered that powerful micro-computers are becoming widely available throughout the world, including the developing countries, to handle these types of tasks. Since such resources were not available in the Unesco pilot project, specific problems of computerization such as selection of hardware and software are not treated here. However, the procedures outlined below are intended to provide a general framework which should be applicable, with relatively minor modifications, to computerized as well as manual systems.

8.1 Research Information

8.1.1. Definition of a "research project"

Research and experimental development is creative work undertaken on a systematic basis to increase the stock of scientific and technical knowledge, including the knowledge of man, culture and society, and the use of this knowledge to devise new applications (see annex 6).

It is wise to have a sufficiently broad interpretation of a research project to allow the collection of all research and related information of national value. This will include significant surveys and studies whether conducted separately or as part of large capital projects. A project could be defined as the smallest self-contained unit of a research programme.

8.1.2. General origin of research information

The majority of relevant research projects, surveys and studies are conducted largely within the country. This is because much research related to the national environment can hardly be undertaken elsewhere and provide realistic results. However, this still leaves the problem of recording the work of visiting researchers and capturing the research which may be undertaken abroad. The solution depends on national measures to ensure registration, like a research permit system, record collection via embassy visa departments and direct contacts with overseas aid organizations with local addresses. This approach would be far more effective and certainly less costly than to attempt to locate and retrieve project and publication details when they have been dispersed in foreign publications.

8.1.3. Subject scope

A national register should ideally include all research on all subjects, but in practice there may be a need to give priority to applied subjects and those of economic importance. Nevertheless, it is important to note that it is considerably easier to collect all projects from any one source organization rather than projects in particular subjects. This is because subject definition and selection is relatively time-consuming and costly.

8.1.4. Sources

These are the research organizations within the country - public and private, central and local government, university, polytechnic and college, consultants and aid organizations. Most sources will be organizations undertaking research, although a few may be large funding organizations sponsoring research. An alphabetical master-list of sources should be maintained, giving the full name, address and a contact for each. The complete record should clearly distinguish current source organizations from those not presently active. Notes about changes and special arrangements for data collection can be attached to each source record.

8.2 Data Collection

8.2.1. Methods of collection

The following alternative methods of collection may have to be employed separately or in combination according to circumstances :

(i) visit and interview
This is a reliable but expensive and time-consuming method which can be useful for a small number of sources, or as part of a large survey when some near and important sources prove uncooperative or when special arrangements for collection have to be discussed.

(ii) postal questionnaire
This is the normal method requiring a well-designed, short to moderate-sized questionnaire with an accompanying explanation, and a good reminder and follow-up system for those who do not respond by a certain date.

(iii) block transfer of existing records
This is the desirable objective, being the easiest and most economic method. It depends upon the cooperation of certain organizations, usually large funding bodies which allow their own house-keeping records of projects to be transferred as a block by manual or computer methods. Sometimes these are financial management records which do not contain all the required elements, or are organized by programme and not by project. The cost and difficulty of such a transfer must then be weighed against direct collection from all the research organizations concerned. The collecting organization could encourage its prospective donors to adopt a special file summary sheet (see annex 2) and even offer to re-format and index housekeeping records

for the benefit of the donor organization and eventual supply to the national register.

Another type of block transfer is the use of secondary sources like research programmes, annual reports and lists sent by some organizations as their only form of return. The monitoring and use of secondary sources becomes important when research surveys are vast in coverage.

Other registers of research and specialized inventories may exist at the national level, particularly in larger countries, and should be contacted as potential sources of information. In smaller countries, however, they may exist only because the national register was not sufficiently well established to provide the required services.

8.2.2. Frequency of collection

Complete survey and collection more than once a year is inadvisable and unlikely to be very successful unless there are special needs and incentives on the part of the majority of the providers. The main concern is to capture new projects and to update information on those already entered and due to be completed during the period of the survey. The product dictates the way in which collection may take place. A complete printed annual register necessitates complete collection annually, within a period of a few months. A database on cards or computer allows a rolling programme with collection by section every three or six months or so. Some administrations collect information on new projects every year and update projects only every second or third year, while others will collect new projects and updates by sector every few months until the cycle is completed in a year or two years.

8.2.3. Essential project information

The amount and type of information required will depend on the needs of the administrator, research manager and research worker. An increase in the quantity and range of the information required results in increased processing costs and increased resistance by sources to completion of the questionnaire. A minimum data set of project elements which are essential to all interests is therefore an important consideration. It should cover the following aspects :

(i) what the project is about;
(ii) where the work is being carried out;
(iii) who is doing it;

(iv) the duration of the project;
(v) who is paying for it and how much;
(vi) the results and documentation.

Several international project description models are available to help in selecting the data elements appropriate to a particular national situation (15, 16, 17).

Project documentation will arise from the initiation stage onwards, and should as far as possible be recorded and linked with the project. Moreover, many research workers can often provide useful additional references to documentation bearing on the subject of the project but not arising directly from it.

8.2.4. Questionnaire design

The size and layout of the questionnaire should be adapted to the type and quantity of information to be collected and the processing system foreseen. On grounds of handling and copying costs, a single sheet questionnaire is preferable provided all the elements considered necessary can be included and clearly understood. The wording, lettering and layout of the questionnaire should be as clear and attractive as possible. The eventual transfer of information from the form is greatly assisted by an order which reflects the printed or other format of the proposed final product. A questionnaire designed as a computer input form requires codes to identify each piece of information.

8.2.5. Collection strategy

(i) solicitation package

This is the set of papers sent out to sources. Each package will consist of :

(a) a letter explaining the requirements and purpose of the survey;
(b) the appropriate number of questionnaires, and if the notes for completion are not on the verso, of separate note sheets for guidance.
(c) any projects previously registered and now requiring updating set out on an update sheet or a partially completed questionnaire;
(d) a self-addressed (and, if possible, postage-free) envelope for return.

Important information about dates for return and contacts for assistance, etc., should be very clearly explained and highlighted by special typeface or underlining.

(ii) distribution

The package should be addressed to those offices and individuals who are most likely to provide a good response. The use of individual names is desirable, but requires a considerable amount of preparatory checking when resurveying, and for this reason "head of department", "Director", "Secretary", etc., may be preferable.

(iii) timing

The dates for dispatch should be considered in relation to time constraints for the source organizations, like university examination terms, end of financial year, public vacations, etc., as well as the general plan for collection and processing of information.

(iv) reminders

These can be sent by duplicated cards and letters, or telephone and telex. High returns depend upon patient explanations to organizations with difficulties and some offers of direct help. A record of existing and required returns is essential for confident handling of reminders. These need to include project details or references to them because there are sometimes incomplete returns and it is necessary to identify precisely the missing information.

(v) record for distribution and receipt

As indicated, it is important to maintain a proper record consisting of what was sent, where and when; what has been received and what needs to be "chased". There will space for the dates and methods of hastening employed, the dates and types of return, and a remarks column for explanations and action. A columned record structure with two organzations per A4 sheet should prove satisfactory.

(vi) updates

These are the project records sent back to the original source organizations a year or so later for alterations and additions. They can be sent in the form of entries cut from the publication of the previous year and pasted onto sheets containing a wording like : "Thank you for the project information below which we received for last year's register. Please tick the data which is still correct and provide amended information in block capitals." In the case of new but incomplete project information obtained from secondary sources, the entry may be sent for update as a partially completed questionnaire. This is more likely to receive attention and a reply than a blank form, and especially so if the intention to publish is emphazised.

8.3. Editing, classification and indexing

8.3.1. Editing

Close examination, correction and clarification of all information on the projects identified is a process that should be carried on continuously from the receipt of the questionnaires, through classification and subject indexing, to final layout and publication. Checking and editing is a time-consuming but important activity requiring careful thought and clear marking of decisions. Editing is operated according to the rules and regulations adopted and consists of : correction of spelling; punctuation; the clarification of expression; identification of omissions; and observance of an order; spacing and general layout.

The overriding concern with the whole of the editing is consistency in employing the standards set. Standards will be required for example, on the form of entry for the research organization; the use of personal titles; the use of capitals; the project format and layout; the use of meanings for terms about project status like "completed" which might mean that the research is completed and not the final report; and the bibliographical format including typefaces, for publication references. Indexes also need standards, for example, on use of initials or names in personal indexes. Standards are needed for addresses where, for instance, either the university address may be used for departments or separate departmental addresses are available.

It is all too easy for the most intelligent staff to alter the spelling of a word when transfering it from the form to a paper slip, to use the first name for the research worker index when the last is the agreed standard, to include "Dr." or "Professor" when these are to be excluded, to put the sub-heading agronomy down without indicating what crop it relates to, or mentioning the crop without tying it to either the cereal or fibre crops category. In short, concentration on the job is required at all stages to maintain consistency and good standards.

8.3.2. Classification function

The main headings of the classification provide :

(i) the contents listing with reference to locations in the printed inventory of research projects;

(ii) the main division headings within the inventory.

The sub-headings can take their place in the same two positions :

a) in the contents to give it more body, perhaps with the use of smaller print to distinguish them from the main headings;
b) in the main text as further headings to make the divisions smaller and more specific.

8.3.3. Classification schemes

Classification can be done by a pre-conceived and established scheme or a scheme developed from a common sense practical approach to the groupings. In the early stages it is wise to consider the relevant value of both approaches.

(i) Established classification schemes

These may be general or special, and include terms from other registers and lists of recommended headings as well as the main headings of suitable thesauri when they are likely to make a practical contribution. The advantages are :

a. the main thinking has already been done
b. there are likely to be reports on user value
c. some prepared schemes may have direct national value.

(ii) Practical development of a scheme

The advantages of this approach are :

a. it can fill gaps where prepared schemes are weak
b. it can modify existing schemes and make them more relevant to local conditions and requirements
c. it provides excellent initial training in understanding of the classification and indexing process.

Although some modification of the scheme may be required in subsequent years to correct errors and reflect changing needs, a degree of stabilization as early on as possible is important if cumulative records and indexes are to be developed and maintained.

The number of sub-headings in any main division will depend to a large extent upon the proportions of the subjects within the collected information, and these proportions will differ from country to country.

8.3.4. Recommended approach to classification

The basic approach to the processing of a substantial number of returned questionnaires is :

(i) Make a series of rough groupings of all the collected projects as a means of checking the subject range and

giving an idea of the proportions.

(ii) Relate the likely needs to existing general and special classifications that could make a realistic contribution to the scheme and to the thinking about the scheme.

(iii) Examine the project descriptions in more detail using all the clues :
   a. the university department or research station section name
   b. the project title and summary
   c. the suggested keywords.

(iv) In the light of (iii) group and re-group with free use of headings.

8.3.5. The subject indexing function

The classification provides the main structure of the work and is a primary tool for useful examination and retrieval of information. Nevertheless, its form and effectiveness are closely related to the supporting function of the indexes, particularly the subject index.

Subject indexing (see annex 8 as an example) is an analytical process of careful identification of essential information in an item, which would not be evident from the classification headings alone. Thus keywords are assigned which allow retrieval when arranged in alphabetical order as an index. The keywords, which may be suggested in the questionnaire and/or assigned, identify such things as states, processes, methods, species, chemicals, etc. As with the classification process assistance may be needed from technical dictionaries and other reference works, as well as subject specialists, for an understanding of the information content of some projects.

The question to be asked is : What is important in this project for the range of potential users as I know them, and how will enquirers be guided to this information when there are one thousand or more entries ? It is important also to continually bear in mind the headings and sub-headings of the classification, and choose keywords that supplement them. An existing thesaurus could be of great assistance in the choice of appropriate terms, but, because of the comprehensive yet specific subject nature of a national register, many general thesauri may not have a great deal of terminology that is really appropriate to the local environment.

Although classification is a grouping of like with like and subject indexing is the more specific analysis of subject content project by project, the success of both processes depends upon knowing the information content and the context. The

importance of information content means that there is practical value in carrying out both the subject indexing and the detailed scrutiny and assignment of subject headings, at the same time. It may well be that the process of subject indexing will lead to the introduction of a new heading or the modification or deletion of an existing one.

8.3.6. Cross references

Cross references are a related, but less important, consideration than classification and subject indexing. They provide a means of linking entries which have important subject content that applies to two headings. A "see also" reference at the end of the appropriate section, linking it to specific projects under other headings, will allow the reader to trace an important related entry in another part of the classification without reference to the subject index. A "see" reference in the subject index directly refers the reader from a term or name under which no entries are listed to a related term or name with entries. Important as their function may be, there should be relatively few cross references.

8.3.7. Recommended approach to subject indexing

Research by its nature is at the forefront of knowledge development, which produces new concepts and subjects which the classification schemes and thesauri are slow to match. Therefore some local innovation is necessary, and acceptable, provided the changes are applied consistently. A systematic approach to subject indexing is very important in this context.

S.R. Ranganathan of India drew attention in the 1930's and after with his COLON faceted classification and chain indexing methods and techniques, to the value of a systematic and relatively mechanical approach to subject indexing which minimized the danger of overlooking useful entries and was relatively economic. According to his method a complete range of terms could be identified for any short subject description, by means of a formula PMEST (personality, matter, energy (i.e. action), space (i.e. location), and time) which prompted the indexer to carefully consider each state in order and extract all relevant terms and act on them as a logical related sequence. The same principles apply to more recent indexing developments like PRECIS (Preserved Context Index System) used by the British National Bibliography.

The subject indexing mechanism is as follows :
(a) Decide on the subject
(b) Fit the terms to thesaurus terms and suitable existing classification

(c) Arrange the terms in order comparable to PMEST
(d) Fit synonyms (if any) to the series of terms above
(e) Rotate the terms for the subject index entries

Example : Breeding and improvement of long staple cotton varieties (S type)

(a) Cotton
(b) Fibre crops
(c) Cotton, long staple varieties - breeding (Sudan)
(d) Breeding = propagation
(e) Cotton - breeding - long staple varieties (S type)
Breeding - cotton - long staple varieties (S type)
Long staple varieties (S type) - cotton breeding

The chain of subject terms identified, as above, could be placed on a subject term summary card. This card is required to carry the indexing terms used for each project so that the intellectual work of classification and subject indexing can be saved, retrieved and used when the project is updated or there is a resulting document. It is suggested that the card (which should not be confused with the temporary indexing slips mentioned below) bear a unique identifier consisting of the project item number from the latest printed volume and the year of that volume;

Example :

```
                        134/83 .... ... ... original identifier
                        192/84 ..... .... new identifier after
                                                        update
Fibre crops
   cotton
   breeding
   long staple varieties
   (S type)
```

3.3.8 Practical considerations

It is important to have a clear workable method for carrying out the classification, subject indexing and cross referencing which is thoroughly understood by everyone involved. The theoretical and practical aspects are both important since the intellectual work of choosing a heading or keyword can be quickly destroyed if the decision is not clearly marked on the questionnaire or the questionnaire is misplaced. The effectiveness of paper clips is quickly reduced after a certain thickness of paper and piles of free papers can in an instant be blown in disorder and waste hours of work. It is therefore essential to use staples, folders, etc. as required, and if possible to reserve sufficient table space for ease of sorting and proper scrutiny, so that the work does not suffer from the constant movement from packing up and setting out each day.

It is useful to check at every stage that all decisions about headings, keywords, cross references, other index terms, identification numbers, etc., are recorded upon each questionnaire and are easily readable. Each questionnaire along with its index slips (see below) should be assigned a unique identification number as early in the process as possible. By this method every questionnaire carries a complete record of the decisions made about the project it bears. This is important when questionnaires have to be dispersed for work among staff, or for scrutiny by subject specialists, or for any other reason.

Many of the questionnaires will be completed in manuscript and difficult to read, or if clearly written or typed, set out in an unconventional manner. Copy typists will need to transfer vital information from each form in preparing the indexes and the main project entry As far as possible the information for transfer should be presented as it is to appear in the published form. The typing of the project description is helped by a questionnaire layout that reflects the required order of the information elements. There may be some value in the use of a template or cut out that only reveals the information to be typed

Having decided upon the forms of the index entries and realizing that they will need to be placed in alphabetical order, there seems to be only one sufficiently reliable manual method, which involves the use of paper slips. The slips, each containing an indexing term and the project identification number, should be securely attached to the questionnaire for the project entry sheet to which the questionnaire data has been transferred and remain there until the order of entries and the numbering of projects is complete. The slips may then be detached and placed in alphabetical order, thus bringing together duplicate headings and enabling their respective entry numbers to be grouped for typing of the indexes. A variant of this method, particularly useful when a very large number of questionnaires must be handled simultaneously as in the Unesco pilot project in Sudan, involves the use of a project entry sheet containing designated space for the entries of the various indexes. These may be continued on another page if necessary before the entry sheet and its continuations are stapled to the relevant questionnaire forms. The advantage of this approach is that it should be easier to staple two or three sheets of paper containing a number of slips (which can later be separated if necessary), than many separate slips of paper. In any case as recommended above all decisions about subject headings, keywords, cross references and serial numbers should be recorded on the corresponding questionnaire form Examples of slips and heading assignment tags are given in annexes 9 & 10 while a model combined entry and index slip sheet is presented in annex 11.

3 3 9 Thesauri

There are two thesauri which proved particularly useful in the pilot project in Sudan and should be considered in

developing and refining the classification structure and indexing procedures for research project surveys and registers in other developing countries. The first is SPINES (9) which was developed by Unesco during the early part of the 1970's. It is designed to permit :

(i) indexing and retrieval of data and bibliographical information concerned with policy making, planning, programming, financing and management of science and technology, including their application to development;

(ii) the indexing and retrieval of ongoing projects in the field of research and experimental development (R&D) for policy-making purposes at the national, regional and international levels.

A comparison of the main headings of the disease classification of SPINES with the headings of the US National Library of Medicine, is a good demonstration of its basic strength (see annex 12). Certain subjects like energy and sociology may need some development, but there are facilities for update and revision. The terminological graphic displays covering 34 subjects are particularly useful for the processes of indexing and retrieval as well as classification, because of the means of quicker visual understanding of the available blocks of terms and their inter-relationship (see annex 13). The main subject terms can be adopted as necessary for a classification scheme. The main part of the thesaurus provides coded terms set in a hierarchy of broader, narrower and related terms.

SPINES is a controlled structured vocabulary with about 10,500 terms of which two thirds are authorized descriptors (preferred terms) linked by 74,000 semantic relations. The updated version with 11,000 terms (i.e. 8,000 descriptors and 3,000 non descriptors) and 80,000 relations is available on magnetic tape from Unesco. SPINES is distinguished from most other systems by being poly-hierarchical, post-coordinated and continuously revised.

Agriculture, because of its extent and economic importance in many developing countries, is likely to require special treatment. The recently published AGROVOC thesaurus (10) produced by the Food and Agriculture Organization of the United Nation (FAO) and the Commission of the European Communities (CEC) is a multilingual agricultural thesaurus with 8 600 terms which has been designed for use and testing with AGRIS and CARIS, both promoted by FAO, as well as other interested information services. It is revealing that since CARIS is a system for research information and AGRIS for literature in agriculture, a logical link is seen between the two and a common thesaurus and classification is now being encouraged by FAO. A similar handling logic should be encouraged in the indexing of research and its resulting documentation in other fields of knowledge.

AGROVOC is presented in straight alphabetical order with each term in its full hierarchical context (broader, narrower and related terms). It deals particularly well with tropical crops and lists crops and domestic animals by scientific and common name. Thousands of common and local terms refer to approved descriptors and are shown in a different typeface. For research registers of broad coverage in developing countries, AGROVOC should be used to complement SPINES if required.

3.3.10 Computers and thesauri

Free-text computer retrieval facilities have brought about the debate between the natural language and the controlled language schools of thought, i.e. "Is the author's own language sufficient, since all words are retrievable, or should input and retrieval be controlled by specially structured and assigned terms ?". The present position appears to be something of a compromise as follows. Although technically all words of a project description can be retrieved by computer, the choice of terms for a perfect search is influenced by the limitations of the human brain. Therefore structured thesauri are valuable at the retrieval stage even if they have not been used at the input stage. Some systems operate thesaurus-assigned terms and free-text computer retrieval together, which is the best of both worlds. This approach may, however, prove very costly and difficult to implement unless a suitable thesaurus and appropriate software are readily available beforehand.

3.4 Production, distribution, publicity and evaluation

3.4.1. Staff and the work schedule

The best use should be made of staff expertise, but an economical work pattern requires that all staff be constantly employed. This means that nearly all will need to become involved in the seemingly straightforward activities like transferring headings to slips of paper, an activity which encourages useful observations upon the questionnaire itself. Staff should be continually reminded about the importance of vigilance against careless errors, especially when the job has a routine element about it and appears to lack stimulation.

It is a good idea for each member of staff to be given responsibility for completion of a section of the register. This may well be organized around subject expertise and preferences. It will be understood that there will have been a mix of staff contributions in the early stages of any one section of the register, but that the important checking, editing and final approval for publication will be the responsibility of a single staff member which will of course allow oversight errors to be traced to him. The staff involved could be specifically acknowledged in the published volume. The general editor will be responsible for the broader standards of the work.

8.4.2. Production methods

Three manual production methods may be used as follows. First the typing or writing of information from the edited questionnaire forms onto entry sheets in the form of cards or paper slips (see section 8.3.3) for sorting and final editing and typing. Second, direct final typing from edited questionnaire forms as received and prior to arrangement in classified sequence, in which case the entries are cut out and pasted in order at a later date. Third, the typing of the final version directly from the edited forms when they are classified and in sequence. Each of these methods has its advantages and drawbacks and the choice should be related to the manpower and resources available. A fourth method is by computer using a coded input questionnaire. This method usually benefits from the experience of a well-established manual system.

8.4.3. Pre-publication use

One reason for using cards or paper slips in the production system is to allow easier exploitation of the information at an early stage. There is however a real danger of disruption and muddle in the processing system if people are permitted to sort and copy parts of the information before services are ready

8.4.4. Short title entries

When a very limited amount of information on a current project has been collected from a source and more is not forthcoming, it is still sensible to use this entry in the full sequence of the publication with appropriate headings and index terms. However, if large numbers of older projects are discovered and considered of value, they may have to appear in title only form in a separate section of the current register. Similarly, printed project entries that have not altered since the last edition, but still represent ongoing activities, might usefully be repeated in a current register as title only with reference to the full entry

8.4.5 Presentation

Running classification headings at the top of each page of modified headings (like SESAME : DISPOSE representing a term and sub-term) are very useful in helping readers navigate through a research register. This is particularly true if there are headings in the text which cannot for reason of excessive length appear in the contents lists since these terms although they

may appear in the subject index, can be made much more visible with running page headings. The difficulty for very wide multidisciplinary fields like agriculture is that there are a number of term levels to be expressed. The use of a bold typeface for text headings is another supporting remedy in this context but could complicate production.

The subject index is an obvious way of gaining quick access to the relevant subject area in the text, and as a frequently used entry point should be located at the very end of the work. Again, the indexes would be more visible with a running head.

8.4.6. Reproduction and printing

The final text may be typed using manual, standard electric or changeable head ("golfball" or "daisy wheel") machines. Changeable heads allow a variety of type faces and sizes to be used. The results can be impressive and they are economic provided there are not too many changes to be made for each entry or page. The weight and type of paper as well as the exact text format and area on the pages prepared for camera-ready copying are important considerations. A smart cover in a colour which may be associated with the register in the future could be useful for identification and publicity. A matt surface which does not fingermark can help to preserve its outward appearance.

8.4.7. Publication link with research

There is obviously limited value in recording research projects unless the conclusions and new information contained in the resulting documents can be easily identified and used. This is dependent on a formal link between the project descriptions and the documented results. Bibliographical references, locations and availability of research documents are therefore important. The subject indexing and classification terms already used for the project should allow some saving of work on the designation of retrieval terms for the documents. The use of a common or similar classification and subject indexing terminology for the projects, the resulting documents, and any current awareness bulletins, is a sensible and economic measure if it is possible to introduce it.

It is probably useful to distinguish works arising from research projects by either housing them as a separate collection, or marking them with an R for example, if integrated into the general stock. Where documentation is not available it is desirable to obtain summaries of the main research results

from the research worker. Consideration should be given to indicating in the Register the existence of documents and their location and availability by some standard code against each project concerned. If the extensive details of the publications are mentioned, however, it is unlikely that the Register will remain for long in one volume.

8.4.8. Links with sources and users

In a recent book on UK science policy (12) containing critical reviews of policies for publicly funded research, Sir Herman Bondi, government scientific adviser in several major areas and former Director-General of the European Space Research Organization says : "Of course, there is no easy division between the definition of an R&D programme and its implementation. There must be the most intensive discussion at all times between all concerned. Everybody pays lip service to communication, but the0very real resources that have to be devoted to communication are often underestimated, and too little is done to ensure this very necessary and extremely important contact between those who direct, those who will use eventually, and those who carry out R&D in their applied sector." He might have gone on to say that a national register of research projects is one important tool and catalyst in this scene.

The information for a register is only collected with the cooperation of the sources who complete questionnaires and make arrangements for their transmission to the register focal point. The receipt of free copies of the Register is something of a payment and encouragement to continue the cooperation which will be needed for further editions. Consequently sufficient copies should be produced to allow for all contributors to receive one, as well as a range of potential users who by interest and/or responsibility wish to examine it, acquire it for reference purposes or simply be aware of its format and existence. Another way to stimulate user interest in the national register would be to convene a national symposium on the project as was done in Sudan (see section 7.2).

8.4.9. Publicity and marketing

This is an aspect that is too often forgotten and one that usually requires professional assistance. Even though free copies of the register may be sent to contributors and others publicizing through technical journals handouts, accessions lists and the media generally should repay the effort by its creation of awareness and demand as well as helping to recuperate expenses and justify the inventory economically.

One might consider a short very carefully-worded handout or leaflet that would highlight some of the more important general administrative and national benefits of the Register, actual and potential. This would be aimed primarily at

administrators and might include the following headings :
(a) value for money
(b) particular advantages of a national research register
(c) capturing information on research concerning the country, including work undertaken or published abroad.

Under the first two headings the low relative cost of a Register as a proportion of the cost of the projects it describes should be emphasized, as well as the role of the Register as only one part of a continuing information system covering research from the awarding of a grant to documented results and with retrospective, current and predictive value, as well as an aid to national planning and budgeting. Such a handout could be distributed with the Register or independently to enlist the cooperation of information sources and to inform prospective users.

8.4.10. Evaluation

A register aiming to cover all national research projects is not really established in the national scene until there is a known national system which is approved by most individuals and organisations involved in research, who support the provision of a regular supply of information to the Register and who depend on the Register and its associated services for their work.

It could be said that there are three objectives and therefore three evaluations involving a national register of research projects.

(a) providing a reister
(b) obtaining some enthusiastic use and response
(c) establishing the register and its associated services as an indispensable national system.

Since the first objective can be evaluated on the basis of straight-forward technical criteria (the existence of a finished product along with the costs and efficiency of production - see, for example section 9.2 - and the third represents a long-term goal beyond the scope of the present project, only the second objective of satisfying immediate user needs will be treated here in further detail.

8.4.11 User survey

It would be useful to conduct a survey to answer the following questions:

(a) who uses the register?
(b) what is it used for?
(c) what other potential users and uses are there?
(d) how can this extra potential be realised?

Any evaluation response sheet designed for this purpose would include questions like:

(a) have you used the volume, if so what for?
(b) are there any improvements you would like to see?
(c) would a register published every two years with supplement between be sufficient?

(d) have you contacted any of the researchers concerning listed projects?
(e) are you aware that the National Documentation Centre is collecting research documentation and identifying document locations for reference and referral as well as for the publication of National Science Abstracts?

An evaluation response sheet could be folded into the Register or sent with the forms for the next round of information collection.

9. Result: The First National Register of Research

9.1. Description of the Register

The National Register of Current Research (11) produced in the context of the Unesco pilot project in Sudan can be characterized as follows:

(a) It is a single volume in English of 552 pages
(b) The 1269 projects represent a response from some 200 sources in the Sudan and some outside.
(c) The information for each project is standardized.
(d) The information is arranged under headings and sub-headings of six broad fields of science.
(e) There are 79 pages of indexes as follows:
  (i) Researchers' index of about 1000 entries.
  (ii) Research organisations' index with entries for the specific units performing the research; 'see also' references are used to connect the parent organizations with the affiliated units performing the research.
  (iii) Subject index where a short context definition is sometimes added to the keywords to make them more meaningful. There are some 1700 index terms
  (iv) Funding organizations index which includes entries for the parent organization funding the research performed by the affiliated research units

(f) There is an address list of about 370 research, collaborating and funding organizations with over 40% from overseas.
(g) There are 12 pages of statistical analysis in the form of diagrams and tables as follows:
  (i) Distribution of research projects by fields of science;
  (ii) Distribution of research projects by sectors;
  (iii) Distribution of research projects by types of activity (fundamental research, applied research, experimental development);
  (iv) Distribution of research centres by regions;
  (v) Distribution of research projects by duration;
  (vi) Distribution of research projects by source of finance;

(h) There is a guide to users page and a list of abbreviations.

9.2. Evaluation of the Register

Until the important complete evaluation becomes available as a result of wide use and user response, it is appropriate to make some immediate judgements about the Register. The single volume is compact and handy. The essential information for each project is clearly presented. Bearing in mind previous estimates the work must contain entries for a very high proportion of the total work in Sudan. All of the large number and wide range of sources approached made a reply. This strongly indicates that the Register is nationally representative.

The information has considerable value-added support in the form of a range of headings and indexes as well as a statistical analysis presented through diagrams and tables. In addition the subject index supports and complements the subject contents arrays and headings in the text. The contents arrays at the beginning of each of the six main subjects together contain some 108 headings and are supported by some 200 further sub-headings in the text. Running page headings were not included in this first volume but should be considered in future editions to improve subject visibility (see section 8.4.5.).

The basic cost of register production was a small proportion of the value of the projects whose descriptions it carries. Although project costs were not given for much of agriculture, it is possible to get a rough idea of total project expenditure in relation to the register production costs:

social science	£S 4 million (given)
medical science	£S 24 million (given)
maths and natural science	£S 4 million (given)
engineering and technology	£S 4 and half million (given)
arts and humanities	£S half million (given)
agricultural science	£S 23 million (estimated)
Total	£S 60 million

Since the average project runs for three years, as the statistical analysis table 4 in the Register shows, a conservative annual expenditure is £S 60 million 3 = £S 20 million. The calculated cost of Register production is less than one per cent of the total annual project expenditure carried.

9.3. Difficulties encountered

Some of the main difficulties encountered were as follows:

(a) The absence of a manual with specific and detailed guidelines and examples for a variety of situations. Many decisions were made, and sometimes remade, as the work progressed.

(b) The language used for compiling the Register was not the mother tongue of the staff employed or the research workers completing the forms. As a result a considerable time was spent in checking and correction of spelling.

(c) Some information needed was not asked for in the questionnaire.

(d) Many forms were hastily completed and many had information missing. During the processing of the information many organizations needed to be contacted again and for many it was not possible to do so by telephone.

(e) It was difficult to handle the forms with so many slips for the different indexes pinned to them until the very final stage of giving the serial numbers. This also made the checking of the index entries pinned to the forms difficult and time-consuming (a combined entry and index slip form will be used in the future - see section 3.3.3.).

(f) The majority of forms were completed by hand, so a great deal of clarification of writing was needed, especially in the medical area.

(g) The section on cost and funding was not completed on the majority of questionnaires. For this reason it was not possible to reliably analyse the responses in terms of breakdown of expenditure by type of organization, subject and sector.

9.4 Updating of the Register

It is planned that a supplement be issued in years when a full edition of the Register is not published, including new projects approved for the current year, as well as projects already

included in the Register which have experienced major alterations and therefore deserve to be listed as new projects. It is suggested that every second or third year (depending on the number of new projects identified) a new edition be prepared. A new questionnaire form has been designed for the collection of information (see annex 14).

9.5. Work on the first supplement

Work on the first supplement started in November 1984 with most of the information being collected by the end of December 1984. The best collection period is considered to be the end-year months because:

(a) The universities will have opened and all the extra work of examinations and accepting new students will have been completed.

(b) Time will have been allowed for the approval of new projects which is sometimes as late as December.

(c) The first register will have been distributed to give motivation for sending information on new research projects.

Analysis of the information collected and preparation of the supplement continued until July 1985, and it was printed and available by the end of 1985.

9.6. Depositing information on research projects at the National Documentation Centre

A byelaw for the National Documentation Centre is in preparation which will include provisions for the second recommendation (points i-iii) of the Unesco consultant report (see section 6.4).

9.7. Application elsewhere

As stated in the preface the Sudanese National Register, along with the present project, report is available within the limitations of resources to Member States as well as interested institutions and individuals. The majority of developing countries have populations of less than 20 million and os are unlikely to generate more projects in progress than can be handled in a single national register; for such countries it is hoped that the results of the present project provide a useful model, to be modified and improved according to the national situation. In the future the development of compatible national systems might usefully lead to regular annual exchanges of research registers among Member States as well as links of national efforts with existing and future regional systems for information exchange.

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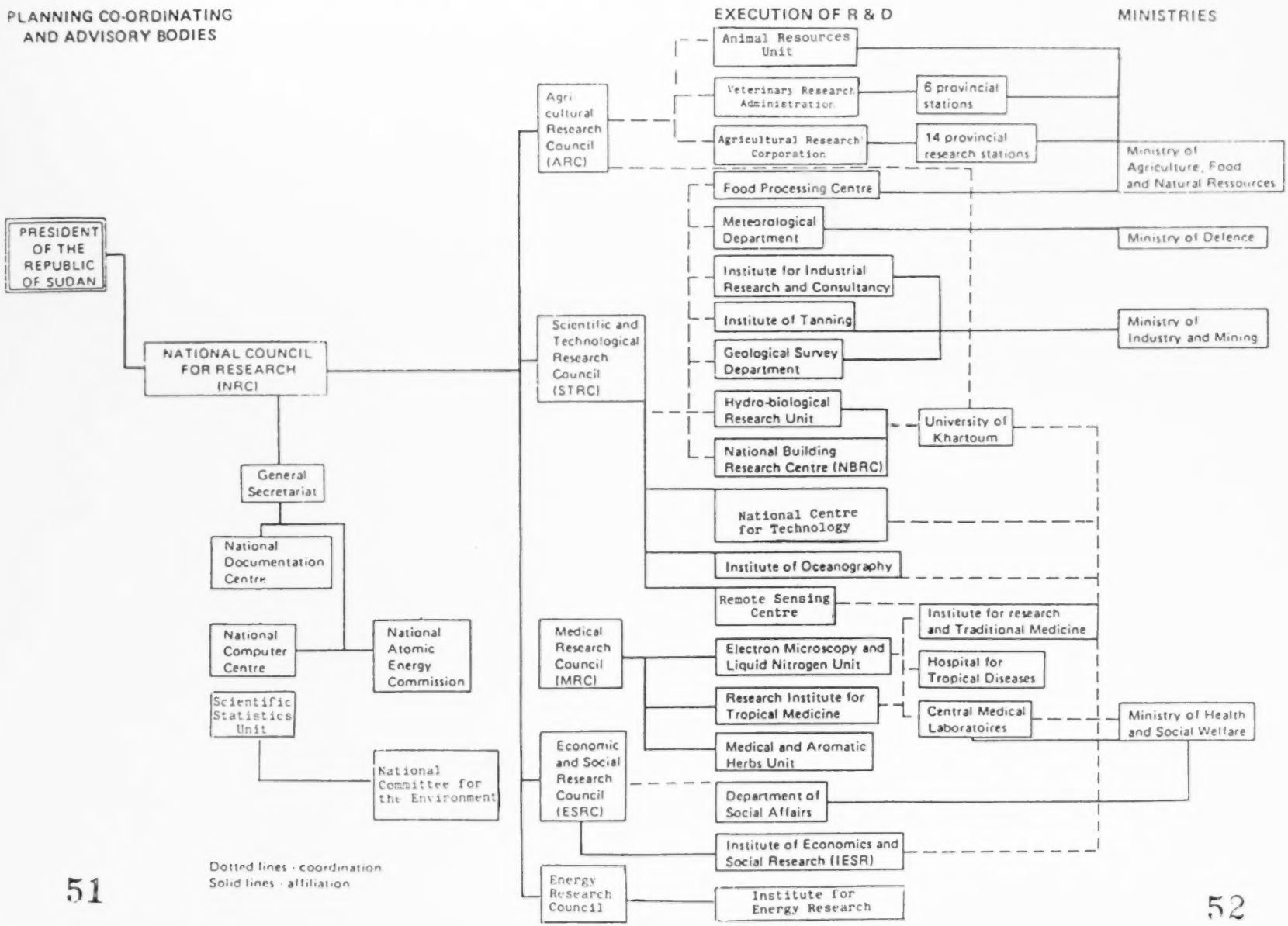
PLANNING CO-ORDINATING AND ADVISORY BODIES
EXECUTION OF R & D
MINISTRIES
PRESIDENT OF THE REPUBLIC OF SUDAN
NATIONAL COUNCIL FOR RESEARCH (NRC)
General Secretariat
National Documentation Centre
National Computer Centre
National Atomic Energy Commission
Scientific Statistics Unit
National Committee for the Environment
Agricultural Research Council (ARC)
Animal Resources Unit
Veterinary Research Administration
6 provincial stations
Agricultural Research Corporation
14 provincial research stations
Food Processing Centre
Ministry of Agriculture, Food and Natural Ressources
Meteorological Department
Ministry of Defence
Scientific and Technological Research Council (STRC)
Institute for Industrial Research and Consultancy
Institute of Tanning
Geological Survey Department
Ministry of Industry and Mining
Hydro-biological Research Unit
University of Khartoum
National Building Research Centre (NBRC)
National Centre for Technology
Institute of Oceanography
Remote Sensing Centre
Medical Research Council (MRC)
Institute for research and Traditional Medicine
Electron Microscopy and Liquid Nitrogen Unit
Hospital for Tropical Diseases
Research Institute for Tropical Medicine
Central Medical Laboratoires
Ministry of Health and Social Welfare
Medical and Aromatic Herbs Unit
Economic and Social Research Council (ESRC)
Department of Social Affairs
Institute of Economics and Social Research (IESR)
Energy Research Council
Institute for Energy Research
Dotted lines - coordination
Solid lines - affiliation

ANNEX 2

OFFICE SUMMARY INFORMATION
for any Project/Survey/Study or Research
(to be placed in the front of files)

NAME(S) of ORGANISATION(S) UNDERTAKING ACTIVITY

1. .....

2. .....

3. .....

TITLE

SHORT DESCRIPTION

NAME AND LOCATION OF PROJECT LEADER (address, telephone No.)

MAJOR FUNDING ORGANISATION(S) AND FINANCIAL RESOURCES OR REFERENCE

START DATE .....

FINISH DATE .....

RESULTS AND/OR PUBLICATION (with location)

REMARKS

ANNEX 3

PROPOSED AMENDMENT TO THE NATIONAL COUNCIL
FOR RESEARCH ACT OF 1977

1. The activity comprising collection, processing, analysis and presentation of the main information elements of research projects is required annually for monitoring, planning and decision-making at all levels.

2. The collection of the above-mentioned information will be carried out by the national Documentation Centre with Presidential authority and with the cooperation of all agencies within the State.

3. The financial and staff resources for this activity will be ensured each year as a separate priority.

4. The following will be made available :
   a. The comprehensive collection of research project information will be appropriately aggregated, analysed and presented in a clear, classified and subject indexed form

   b. The National Documentation Centre will record and house all format findings and results arising from each of the research projects and provide ready access to the information.

5. Similarly, the NCR Science Statistics Unit will be accorded financial and staff resources to carry out every third year the survey of national scientific and technological potential concerning information on organizations and units and their finance, personnel and equipment. The collected information will be anlysed and prepared for easy use in a published form.

6. The NDC and SSU will work together in those cases where a sharing of knowledge, expertise or activity will avoid duplication and improve the effectiveness of the operation and/or product.

ANNEX 4

AGRICULTURAL RESEARCH CORPORATION
PROVISIONAL PROGRAMME OF WORK SEASON
1982 - 1983

Station Section

Name of Scientist(s)

Subject or Crop if any :

Title of Project or Expt' :

Duration Season

Objective

Methods (treatment, design, apparatus, etc.) :

Observations (samples, data to be collected) :

Cost .

Chapter I (overtime, etc.)
Chapter II
Chapter III

Remarks :

ANNEX 5

THE NATIONAL COUNCIL FOR RESEARCH
National Documentation Centre
Research Project Survey 1982

Name of research organisation :
Unit .....
Main body .....
Address .....
Telephone No. ..... Province .....
Other collaborating research organisation :
.....
.....

Title of research project (including surveys and studies of significance)
.....
.....
Main type of activity of the research project (tick where applicable)
Fundamental research __ Applied research __ Experimental development __

Project leader .....

Number of co-investigators ____ (giving their names and organisations if different from first organisation above) .
.....
.....
.....

Short summary of project including objectives :
.....
.....
.....
.....
Funding organisations (s) giving the total project financed :
Estimated cost ..... Source(s) .....
.....
Start date ..... Probable duration in months .....

Reports/Publications/Patents arising specifically from this project :
(Please continue on second sheet if necessary)
.....
.....
.....

Suggested indexing terms (keywords describing the research project)
.....
.....
Name of person completing form .....

Signature ..... Date .....

ANNEX 6

Two Criteria for Distinguishing between Fundamental Research, Applied Research, Experimental Development : the goal and the visible product of the activity

Fundamental research

- the acquisition of new knowledge without any goal extrinsic to science, such as the socio-economic objectives laid down in a national development plan;

- the visible product of fundamental research is a written report

Applied research

- the acquisition of new knowledge with a goal extrinsic to science, such as the socio-economic objectives laid down in a national development plan or specific agricultural or industrial applications;

- the visible product of applied research is a written report

Experimental development

- the development of a new or improved product or process, drawing on existing knowledge;

- the visible product of experimental development is a tested prototype or a pilot plant or farm; this product becomes an innovation when it is applied or used successfully in the regular system of production.

ANNEX 7

MAIN ELEMENTS OF THE LECTURE AND DISCUSSIONS
AT THE NATIONAL SYMPOSIUM IN KHARTOUM

Some of the basic values of a research register which should be appreciated in varying degrees by research workers, research managers, administrators and decision makers at all levels, are as follows :

Research subjects and projects are carefully considered and financed, and therefore as a matter of logic, deserve some basic accountability records to monitor progress and secure usable results.

A well organised research register can be both a record and a finding tool for identifying research information by subject, pointing to individual and corporate expertise, allowing aggregation of records for statistical analysis, and providing the means of tracing published and unpublished results.

A register is part of the means of knowing about and effectively using what has been paid for and created. There is an important link between research expenditure and the knowledge and use of research results, and economic development. The total cost of a research register is usually well under one percent of the value of research which it carries.

The elimination at the planning stage of what would otherwise be duplicate research, allows savings and increases the effectiveness of the research budget. A true story illustration is of a member of staff of a university department who had been engaged in research on bacteria and oil for some considerable time. One day he was examining his instruments slung under a very large floating raft moored off the coast. He had made the lonely inspection many times before, but on this occasion there was another person on the raft. The stranger revealed that he was a researcher from a marine research institute in the same country, and was engaged on a study of bacteria and oil with the assistance of instruments hanging under the raft.

Earlier knowledge of research findings can bring benefits and savings, by allowing appropriate results to be applied earlier. This is particularly the case with interdisciplinary work which is such a feature of many development objectives, and is likely to increase as wider implications are taken into account.

Comprehensive research project information can help to improve the definition and nature of aid when making representations to international funding organisations and donor countries.

Similarly this same knowledge helps to improve the evaluation of aid proposals from donor organisations and countries, and ensure that they are related to local needs and conditions.

The recent increased attention to the potential value of scientific approaches to traditional methods, and the reappraisal of some western methods, puts a greater premium on research, especially when related to interdisciplinary objectives. The groupings and information retrieval facilities of a good national register assist the identification of projects and results. The National Council for Research set up a traditional medicine research institute in 1980, and research on Sudanese plants and herbs of medicinal value feature in several projects in the current collection. The World Health Organisation is concerned that drugs are too easily and widely promoted as an alternative to traditional health care.

Another example is at the University Hospital, Soba, which is involved in traditional water purification using modern science to make traditional materials more effective, eg. Alum/Shabb, Aluminium Sulphate, horse beans, groundnuts and various roots and bark for treatment of water.

Similarly there has been an experiment of complementary animal and crop production in Western Sudan. The acacia albida increases its foliage in the dry season and loses the leaves in the rainy season. Cattle shelter under the trees in the dry months, and then sorghum and millet are grown under the trees in the rainy season to thrive upon the nutrients from the trees and the animals.

In the area of desert encroachment, the recent joint work of the universities of Khartoum and Swansea has shown that the problem is a good deal more complex than just climatic change and vegetation destruction. Agricultural practices, crop trampling and water shortage for economic rather than environmental reasons, are some of the more detailed considerations which are thought to be causes which are controllable.

There are direct savings from the application of appropriate new findings, eg. the annual cost of repairing termite damage to buildings in Khartoum will soon be approaching £1M a year. Therefore the potential value of the current work of the Centre for Overseas Pest Research in London and the University of Khartoum, is considerable. Again, 20% of total grain loss occurs during storage. The work of the FAO and the National Council for Research on this problem, therefore involves considerable potential savings.

A register of projects provides a mechanism for tracing research reports, theses, studies and surveys, etc., whether published or unpublished. Much is produced in unconventional ways, being known as "grey literature" because it does not have the usual listings and bibliographical controls.

The costs of not knowing about the relevant information, of knowing too late, of vain searching and of duplication, can be converted into savings by good cooperation in the production of a comprehensive and well indexed register of current and recently completed research projects which is well known and well used. The appropriate bibliographic and documentary control of the results, in whatever form they may be presented, is also most important.

This is because it enables useful results to be quickly identified and applied. It is also a check and demonstration of value for money, and helps to satisfy the administrative needs of the commissioning and funding organisations. In addition it acknowledges and perhaps encourages good work of individuals and teams.

Advantages of a national register for Sudan

There are distinct advantages for a country like Sudan in the development of a national register. These consist of a large percentage of the research work, or the records of the research work, being in the capital area and so easing collection. Secondly, the ability to encompass descriptions of all current and recent research in one volume, is a great saving in production and distribution costs, and also makes use of the information easier. Thirdly the conduct of mainly environment related research ensures that much of the work of each project has to be carried out in situ if it is to have any likely value. This in turn allows early identification of work, especially by overseas researchers.

One nationally conducted register has distinct advantages, because it does not suffer from the difficulties experienced in many countries where subject overlap of the numerous organisations supplying the information leads to understandable resistance to the completion of numerous questionnaires for various registers. This in turn leads to numbers of incomplete registers which are not easy to find out about and therefore tend to be underused. Adverse criticism of some of the registers follows on the grounds of low demand, relatively high cost and limited value.

Success depends very much on the ability and dedication of the research register compilation team.

Capturing overseas research and work published abroad

Many professionals are working abroad and many produce research and studies of significance to their homeland. In addition nationals of many other countries are studying and writing about matters of direct national relevance.

Those trained abroad tend to think of publication of research results in overseas and international journals. This circumstance can disperse relevant information which can be difficult or impossible to trace or obtain in the home country. Some work is not published, much is not formally published, and much is not presented for wider consumption until years after the discovery or conclusions. For all these reasons an early reliable method of tracing results from a central register record is important.

Publication gives access to information but can also disperse information and make it difficult to collect and use. Hence the need for bibliographical control : the collection and control of information before dispersal.

The suggestion that Embassy visa departments all over the world could readily pass back information on those visiting the country to conduct research, is worth considering as a byelaw for the registration of overseas researchers with the National Centre.

Organising more effective collection of research in Sudan

As already mentioned the research of greatest importance, in terms of numbers of projects, will be that conducted within the country. It is this information that should be captured more effectively by means of four strategies :

(i) Cooperative arrangements with the main national and international organisations and agencies concerned with funding and development work and research; eg. European Development Programme, Embassies, etc.

(ii) Specific arrangements which benefit nationally located organisations with the maintenance of housekeeping records, and at the same time assist the regular provision of useful register information, eg. by the use of file summary sheets.

(iii) The standardisation of institutes research and development contracts, including directions for the proper collection of the results and publications arising from the research expenditure.

(iv) Special indexing by the national centre of papers, reports and publications for other organisations, and/or the housing of collections of papers and documents for national use. If the appropriate documents cannot be released to the National Centre, advice should be given to the organisation for internal housing and access by bona fide research workers and others.

The existing legal deposit law needs re-examination in the light of these requirements, to see how far it supports or can be altered to support the collection of research results.

In all these proposed cooperative arrangements the Ministry of Finance and Planning is likely to have a significant part because of its central position in the aid programme.

Administrative and professional resistance to cooperation

Varying degrees of resistance are likely to be experienced from some administrators and professionals in the organisations that are essential to the national cooperative effort. Some of the lack of cooperation will be genuine pressure of work, staff shortages, illness, etc., and help should be provided where possible; but sometimes the following will be the reasons, although others may be presented as an explanation :

(i) Professionals sometimes feel threatened or too closely supervised by central records of their work, which allows others to point out related work in their area about which they may not know.

(ii) Research managers may be afraid that their research plans for employing their research station staff or research students, and/or pursuing particular interests, may be upset by administrative interference.

(iii) Some administrators and decision makers seem afraid that the aggregation of research project information will extend their options and make their job more difficult.

Fortunately, many administrators and professional see the value of research project information to them personally as well as in the national context.

ANNEX 8

SUBJECT INDEX
(numbers refer to projects)

American bollworm 25, 30
Bacterial blight 62, 63, 67, 71, 77
Biological control agents 33
Breeder seeds 113
Cluster transfer 73
Defoliants 1, 2, 21
Drought resistance 71
Earliness 73
Flea beetle 47
Germplasm 76
Green ridging 9
Growth regulator 4, 14
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  activity 84
  combination 83
  Ronster and Modow 85
  selectivity 84
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Insecticides 23
  evaluation 34, 36, 37
  selectivity 42, 43
  Temik 27, 44
Interspecific crosses 74
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Lint 75
Mycotoxins 49
Nitrogen
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  level 35
  requirements 76
  response 64, 53
  sources 36, 45, 78
Pest population 45
Plant density 15
Potassium 87
Root rot 89
Rotation 23
Seed dressing 23
Seed foliage 12
Seed rate (cotton) 21
Soil 89, 65, 54
Sowing rate 12
  cotton 65
  wheat 34
Spacing 46

Spraying 90
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Urea 78
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Viruses 56
Water stoppage 10, 14
Weed competition 2
Whitefly
alternate host 15, 16
bionomics 87
population 56
Wilt 54
fusarium wilt 1
syndrome 4, 5
Yield 6, 7

NB This short trial index based upon cotton and wheat only showed the following :

(a) the need for a new heading fertiliser in view of the number of nitrogen entries as well as urea and potassium;

(b) the need to check named herbicides and insecticides and place them under specific and general references;

(c) the need for alternate means of indicating sub-heads in the index especially when expanded to cover all crops.

ANNEX 9

1.

AGRICULTURAL RESEARCH
CORPORATION

Statistics & Agricultural
Economics Section

125

N.B. Information for 1 and 2 can go straight on to slips and be pined behind every form

Project identification number

RESEARCH ORGANISATION

N.B. There may be more than one

2.

MANSI, Morid Girgis

125

RESEARCH WORKER

N.B. There may be more than one

3.

Insect Distribution

CR Agronomy

125

N.B. 3 is produced later from the keywords and cross references pencilled on the questionnaire forms

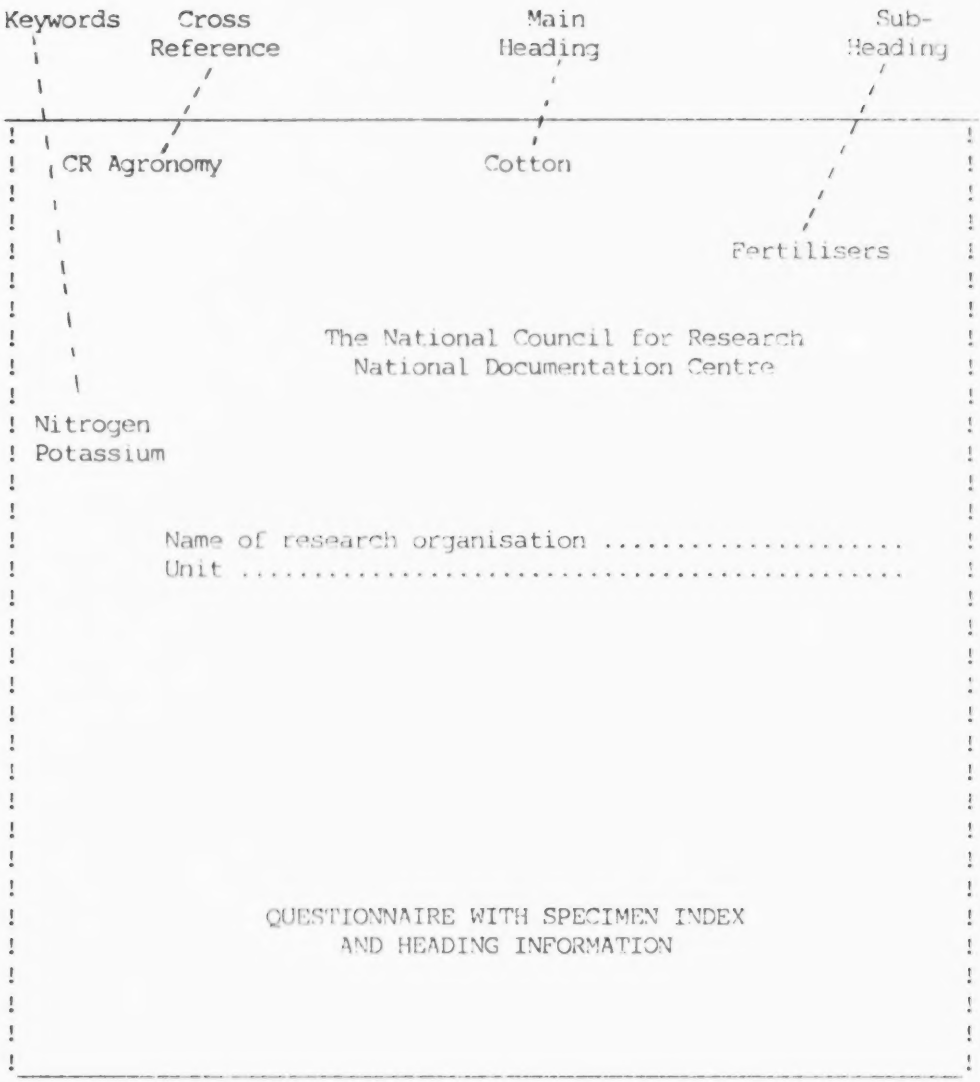
KEYWORD & CROSS REFERENCE

N.B. There is likely to be more than one keyword

SPECIMEN INDEX SLIPS

N.B. In all cases one entry per slip to allow sorting into alphebetical sequence

ANNEX 10


Keywords
Cross Reference
Main Heading
Sub-Heading
CR Agronomy
Cotton
Fertilisers
The National Council for Research
National Documentation Centre
Nitrogen
Potassium
Name of research organisation .....
Unit .....
QUESTIONNAIRE WITH SPECIMEN INDEX
AND HEADING INFORMATION

ANNEX 11

Project No. _____

NAME OF PARENT RESEARCH ORGANISATION, Name of the research Unit: _____

Title of the research project:

Objectives of the research project:

Names of project leader and co-investigator(s), and their organizations (s):

Start date and completion date:

Funding organization(s) giving total project finance:

COMBINED PROJECT ENTRY AND

INDEX SLIP SHEET

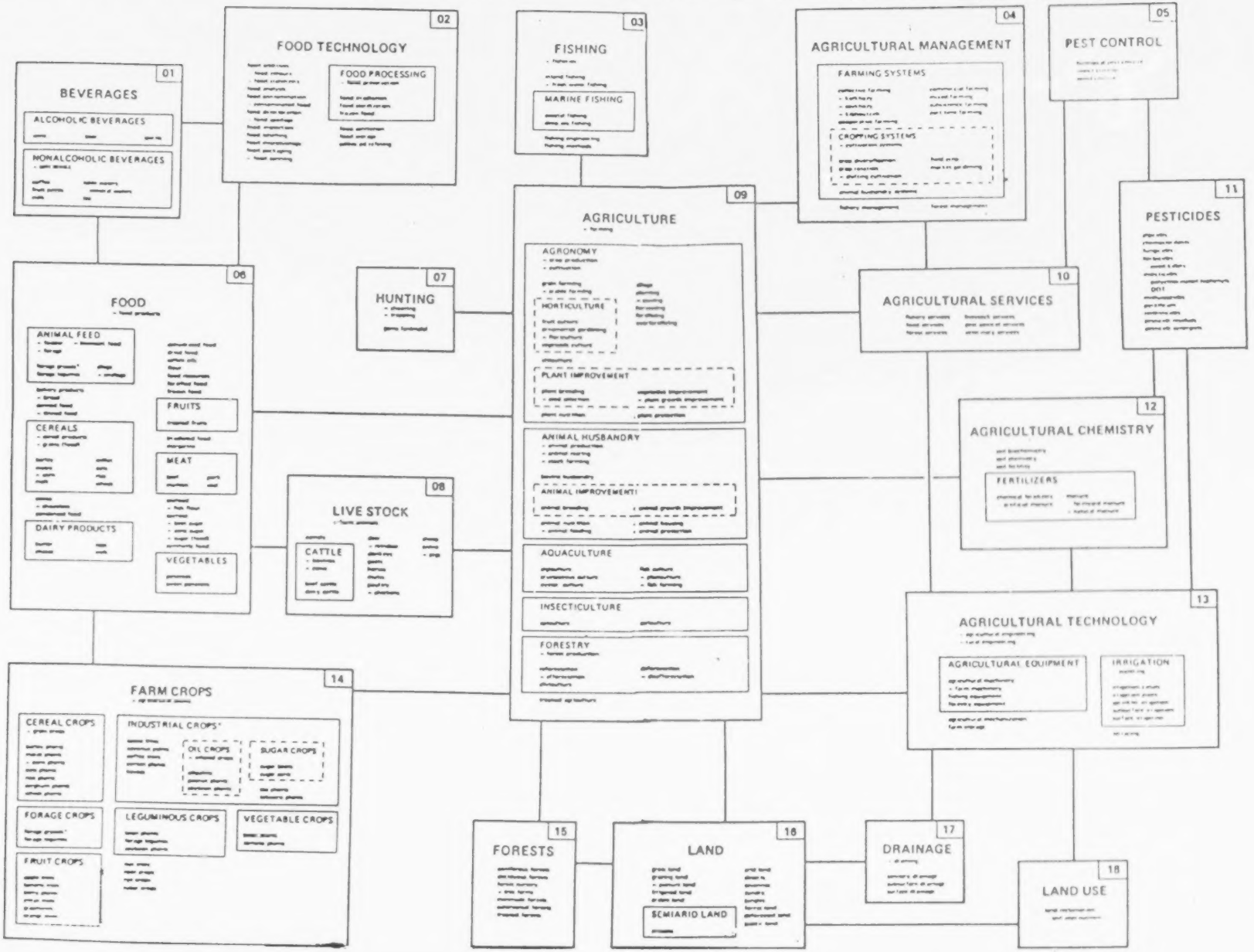
ANNEX 12

COMPARISON OF DISEASE CLASSIFICATIONS FROM THE NATIONAL LIBRARY OF MEDICINE SUBJECT HEADINGS AND THE UNESCO SPINES THESAURUS

NLM (US) Medical Subject Headings	Unesco SPINES Thesaurus
1. Bacteria and fungal	Heredity
2. Virus	
3. Parasitic	Infectious
4. Neoplasms	bacterial (1)
5. Musculoskeletal	parasitic (3)
6. Digestive	rickettsial (5)
7. Oral	tropical
8. Respiratory	venereal
9. Otorhinolaryngologic	viral (2)
10. Neurologic	
11. Ocular	Neoplasms (4)
12. Urologic	malignant
13. Female genital	
14. Cardiovascular	Digestive (6)
15. Hernic and Lymphatic	gastrointestinal liver
16. Neonatal	
17. Dermatologic	Mouth (7)
18. Nutritional and metabolic	tooth
19. Endocrine	
20. Immunologic	Respiratory (8)
21. Occupational and poisoning	lung
22. Animal	
23. General pathology	Otorhinolaryngologic (9)
	Ear
	Eye (11)
	Urologic (12)
	Gynecologic (13)
	Pregnancy (13)
	induced
	Cardiovascular (14)
	heart
	vascular
	Hematologic
	abnormalities
	Occupational (21)
	Metabolic (18)
	Nutritional (18)
	Endocrine (19)
	Immunologic (20)
	Poisoning drug (21)

NB Numbers given against the SPINES terms are for cross reference with the NLM headings

SPINES THESAURUS. TERMINOLOGICAL GRAPHIC DISPLAY : AGRICULTURE



New NDC questionnaire ANNEX 14

RESEARCH PROJECTS SURVEY 1983/1984

1. Name of unit performing the research .....
   Address .....
   .....
   Tel.No. ..... Province .....
   Main body of unit .....

2. Name and address of research organizations collaborating in performing the research :
   .....
   .....
   .....
   (use more space if necessary)

3. Title of research project (including surveys and dissertation) :
   .....
   .....

4. Short summary of project including objectives :
   .....
   .....
   .....
   .....
   .....

5. Main type of activity of the research project (tick most relevant box):
   Fundamental research Applied research
   Experimental development

6. Name of project leader
   .....
   Names of co-investigators
   .....
   .....

7. Is the research being undertaken for a degree ?
   Yes ..... No ..... Which degree .....

8. Funding organisations (give names, address and budget) :
   .....
   .....
   .....

9. Total budget .....

10. Starting date ..... Estimated completion date .....

11. Suggested indexing terms (keywords describing the research project) :
.....

12. Language used for publishing results of the research :
Arabic English

13. Publication arising from this research (continue on a second sheet if necessary)
.....
.....
.....
.....
.....
.....

14. Name of person completing form .....
Position ..... Signature .....
Date .....